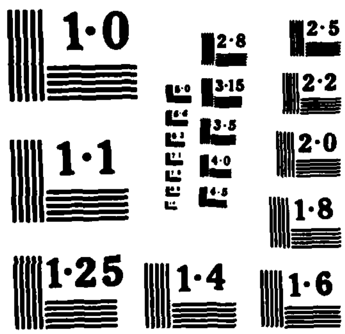
AD-A158 068 EMPLOYMENT TRENDS IN HIGH-TECHNOLOGY OCCUPATIONS(U) 1/1
NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER SAN
DIEGO CA M K NAKADA ET AL. JUL 85 NPRDC-TR-85-20

UNCLASSIFIED F/G 5/9 NL

END
FILMED
DTIC



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

2

NPRDC TR 85-20 JULY 1985

EMPLOYMENT TRENDS IN HIGH-TECHNOLOGY OCCUPATIONS

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER
SAN DIEGO, CALIFORNIA

NAVY PERSONNEL RESEARCH
AND
DEVELOPMENT CENTER
San Diego, California 92152

NPRDC TR 85-20

July 1985

EMPLOYMENT TRENDS IN HIGH-TECHNOLOGY OCCUPATIONS

Michael K. Nakada
Alberto R. Jerardo

Reviewed by
Joe Silverman

Approved by
Martin F. Wiskoff

Released by
J. E. Kohler
Commander, U.S. Navy
Commanding Officer

Navy Personnel Research and Development Center
San Diego, California 92152-6800

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION: UNCLASSIFIED

1b. RESTRICTIVE MARKINGS

2a. SECURITY CLASSIFICATION AUTHORITY

2b. DECLASSIFICATION / DOWNGRADING SCHEDULE

3 DISTRIBUTION / AVAILABILITY OF REPORT: Approved for public release; distribution unlimited.

4 PERFORMING ORGANIZATION REPORT NUMBER(S): NPRDC TR 85-20

5. MONITORING ORGANIZATION REPORT NUMBER(S)

6a NAME OF PERFORMING ORGANIZATION: Navy Personnel Research and Development Center

6b OFFICE SYMBOL *(If applicable)*: Code 61

7a. NAME OF MONITORING ORGANIZATION

6c. ADDRESS *(City, State, and ZIP Code)*: San Diego, CA 92152-6800

7b. ADDRESS *(City, State, and ZIP Code)*

8a. NAME OF FUNDING / SPONSORING ORGANIZATION: Chief of Naval Operations

8b. OFFICE SYMBOL *(If applicable)*: OP-01

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: Washington, DC 20350

8c ADDRESS *(City, State, and ZIP Code)*

10 SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO	TASK NO.	WORK UNIT ACCESSION NO
			WRB2175

11 TITLE *(Include Security Classification)*: EMPLOYMENT TRENDS IN HIGH-TECHNOLOGY OCCUPATIONS

12 PERSONAL AUTHOR(S): Nakada, Michael K., Jerardo, Alberto, R.

13a. TYPE OF REPORT: Technical Report

13b TIME COVERED: FROM 84 Jan TO 84 Jun

14 DATE OF REPORT *(Year, Month, Day)*: 1985 July

15 PAGE COUNT: 46

16 SUPPLEMENTARY NOTATION

(URL)

17 COSATI CODES

FIELD	GROUP	SUB-GROUP
05	09	

18 SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*: Unrestricted line officer, projections, supply-demand imbalances,

19 ABSTRACT *(Continue on reverse if necessary and identify by block number)*

The projected decline in the U.S. youth population in the next decade has been well documented. College graduates, a primary source for the Navy's unrestricted line officers, in the fields of engineering, mathematics, physical or life sciences, and computer science will be in greatest demand. Such competition may have adverse effects on the Navy's ability to attract and retain its officers. This research assessed employment trends and projections to estimate the severity of this potential problem. Employment is projected through 1995 by industry and occupation. The geographic locations of these high-technology industries and occupations are projected and supply-demand imbalances are identified.

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT: ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS

21. ABSTRACT SECURITY CLASSIFICATION: UNCLASSIFIED

22a NAME OF RESPONSIBLE INDIVIDUAL: Nakada, Michael K.

22b TELEPHONE *(Include Area Code)*: (619) 225-2371

22c. OFFICE SYMBOL: (Code 61)

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

FOREWORD

This research was performed under task area WR-B2715 (Unrestricted Line Officer Assessment) and sponsored by the Chief of Naval Operations (OP-01). The overall objective of this task area is to analyze the current status of the unrestricted line officer community, quantify the environmental trends likely to impact these officers, and assess the Navy's ability to meet its needs for unrestricted line officers over the next decade. As one of five related reports, this report presents an assessment of the economic issues and trends that affect the unrestricted line officer community. The results are intended for use by military manpower and personnel managers.

Appreciation is expressed to Dr. Aline Quester of the Center for Naval Analyses for her data sources and helpful comments.

J. E. KOHLER
Commander, U.S. Navy
Commanding Officer

J. W. TWEEDDALE
Technical Director

SUMMARY

Problem

The private sector's demand for scientists, engineers, and technicians can affect the Navy's ability to recruit and retain officers. Growth in the demand for college graduates with science or engineering degrees is predominantly the result of the growth in occupations that require formal technical training. The decline of heavy industry and the concomitant rise of service and high-technology industries have generated increased competition for scientists and engineers whose supply appears to be chronically limited. This supply-demand imbalance in particular technical skills may have consequences for the Navy's ability to attract officers and keep them in service. An assessment of the market for college-educated, technically oriented personnel is essential in formulating Navy manpower, personnel, and training policies.

Objective

The objective of this research was to evaluate employment trends in high-technology industries and occupations.

Approach

High-technology employment trends were extracted from recent surveys available in the professional literature. First, the industries that the U.S. Department of Labor's Bureau of Labor Statistics (BLS) classifies as "high-technology" were reviewed. Employment growth in these industry groups portrays one picture of the demand for high-technology personnel. Second, high-technology employment growth, much of which occurs in high-technology industries, was analyzed by occupation.

High-technology employment trends and projections were obtained from publications by the BLS, which assumed straight-line projections in the growth of high-technology employment by industry group and by occupation. Three forecast scenarios were considered in these projections.

The geographic distribution of high-technology jobs by industry was reviewed to identify particular regions in the United States that will continue to require graduates in high-technology fields. Finally, civilian compensation packages were compared, using examples from selected companies and from the federal government.

Results and Conclusions

By 1995, civilian employment is projected to reach 127 million--a 25 percent increase from 1982. Employment in high-technology industries, in comparison, will experience 34-35 percent growth over the same period. The BLS projects that 1.5-1.6 million new jobs will be created in the technology-oriented sector. The occupations that will experience the largest growth are engineers, scientists, computer specialists, and related technicians. New openings for computer specialists and engineers are projected to be 81 and 49 percent respectively above 1982 openings. The average growth for all four occupations is expected to be 44 percent in this 13-year period.

While the economy is expected to generate 25.6 million more jobs between 1982 and 1995, only one fourth of the fastest growing occupations require a college degree. The U.S. Department of Labor estimates only 10.2 of the 13.5 million college graduates

between 1978 and 1990 will find work in their major field of training. Among the fields of study whose graduates equal or exceed the number of job openings are engineering, chemistry, economics, geology, and geophysics. In contrast, the demand for computer professionals will exceed the total of awarded degrees.

In recent years, high-technology industries have accounted for a relatively small proportion of all new jobs nationwide, but have provided a significant proportion of new jobs in some states and areas. Most high-technology employment is located in the largest metropolitan areas. The top five metropolitan areas in each state account for 72.7-93.2 percent of the high-technology jobs, depending on the state and job definition used. The Los Angeles area, with a large aerospace industry, shows the highest level of high-technology employment by a large margin over San Jose and "Silicon Valley," which, however, has the highest proportion of high-technology jobs in California regardless of job definition. Eight states--California, New York, Texas, Massachusetts, New Jersey, Florida, Illinois, and Pennsylvania--have the most high-technology employment, ranging from 57.4 to 66 percent.

Although job openings in technology-oriented firms continue to increase, starting salaries have not risen significantly since mid-1983. Engineering disciplines reported the highest salary increases, ranging from 1 percent to slightly more than 4 percent. Petroleum engineers averaged the highest monthly offer at $2502 in 1983. Job benefits, however, have greatly improved in comparison to those offered by the federal government.

Recommendations

1. In the next decade, the Navy should carefully monitor the high-technology labor market and have in place the mechanisms needed to combat potential unrestricted line (URL) officer shortfalls, particularly for computer professionals.

2. If the present demand for technically trained graduates is sustained, the armed services should assess the benefits currently offered military officers. Either higher pay or an enhanced benefits package may have to be implemented if the military is to attract and retain officers in skill shortage categories (e.g., computers).

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Problem

The private sector's demand for scientists, engineers, and technicians can affect the Navy's ability to recruit and retain officers. Growth in the demand for college graduates with science or engineering degrees is predominantly the result of the growth in occupations that require formal technical training. The decline of heavy industry and the concomitant rise of service and high-technology industries have generated increased competition for scientists and engineers whose supply appears to be chronically limited. An assessment of the market for college-educated, technically oriented personnel is useful in formulating Navy manpower, personnel, and training policies.

Background

An average of 58 percent of Navy officers commissioned since 1970 have bachelor's degrees. In recent years, the proportion with postgraduate degrees has risen. In the same period, the number of officers with only high school or a little college education has declined (see Appendix A). The Navy's orientation toward advanced technology has influenced officer recruitment in the direction of technical-degree holders. The largest source of officer accession remains the college market, especially science and engineering majors. From 1970 to 1980, the number of bachelor degrees awarded in engineering and science (life, physical, mathematical and computer) in the United States grew by 20 percent, an increasing portion of which was accounted for by women. The number of degrees awarded grew by 83 percent for women and 7 percent for men (see Appendix B).

While the number of scientists and engineers increased in the 1970s, their proportion with respect to all degrees awarded dropped. In 1970, 12 percent of bachelor degrees were in engineering, mathematics, and physical science (EMP). This proportion fell to 9.1 percent in 1975, but rose again to 11.2 percent in 1980 as a result of the continued increase in engineering and a drop in the social sciences (Vetter, 1982).

Objective

The objective of this research was to evaluate employment trends in high-technology industries and occupations.

APPROACH

High-technology employment trends were extracted from recent surveys available in the professional literature. First, for industries that the U.S. Department of Labor's Bureau of Labor Statistics (BLS) classifies as "high-technology," the demand for scientists and engineers was studied by industry groups. Second, high-technology employment growth, much of which occurs in high-technology industries, was examined by occupation.

High-technology employment trends and projections were obtained from BLS publications. Straight-line projections were assumed for high-technology employment by industry group and by occupation using three forecast scenarios; their underlying assumptions are outlined in Appendix C.

The geographic distribution of high-technology workers throughout the United States was identified by industry group and state, using maps that depict recent concentrations

of workers. Recent trends in the geographic concentration of high-technology workers were considered presumptive indicators of employment demand.

Finally, starting salaries of engineers and scientists were reviewed in both private and federal employment. Benefits and employee participation rates in medium and large firms were assessed; the compensation packages of two selected companies were compared with the federal government's (see Appendix D for specific employee benefits).

RESULTS

Employment Projections in High-Technology Industries

The principal criteria used by the BLS in classifying high-technology industries were:

1. Research and development expenditures.
2. Use of scientific and technical personnel.
3. The nature of the industry's product.

The BLS defines scientific and technical personnel as engineers, life and physical scientists, mathematical specialists, engineering and science technicians, and computer specialists. Most workers in technology-oriented occupations are directly involved in developing or applying new technologies. Their work requires basic knowledge of the principles of science, engineering, or mathematics; these principles are normally acquired in college. Based on the three principal criteria, BLS (Riche, Hecker, & Burgan, 1983, pp. 52-53) formulated three definitions of high-technology industries to facilitate employment projections:

> Group I: Technology-oriented workers accounted for a proportion of total employment that was at least 1-1/2 times the average for all industries.
>
> Group II: The ratio of research and development (R&D) expenditures to net sales was at least twice the average for all industries.
>
> Group III: The proportion of technology-oriented workers to total employment in the industry was equal to or greater than the average for all manufacturing industries (6.3%), and the ratio of R&D expenditure to sales was close to or above the average for all industries (3.1%).

BLS classified the nation's industries according to each of these definitions of high technology (see Table 1) and projected employment by the three industry groups (Table 2) for three scenarios of economic growth: low, moderate, and high. In comparison to moderate growth, the low-growth scenario assumed higher proportions of government spending, especially in defense and in transfers and grants. The high-growth scenario assumed that the Federal Reserve (Board of Governors) would pursue a less restrictive money supply policy to bolster or sustain economic growth (see Appendix C for historical and projected growth rates of the gross national product, disposable income, and employment under each scenario).

As shown in Table 2, high-technology employment is projected to grow somewhat faster than "all wage and salary workers" under all growth alternatives. The low-growth

Table 1

High-Technology Industry Classification

Industry	High Technology Group[a] I	II	III
Crude petroleum and natural gas.	X	--	--
Heavy construction, except highway and street.	X	--	--
Industrial inorganic chemicals.	X	--	X
Plastic materials and synthetics.	X	--	X
Drugs.	X	X	X
Soaps, cleaners, and toilet preparations.	X	--	X
Paints and allied products.	X	--	X
Industrial organic chemicals.	X	--	X
Agricultural chemicals.	X	--	X
Miscellaneous chemical products.	X	--	X
Petroleum refining.	X	--	X
Tires and inner tubes.	X	--	--
Cement, hydraulic.	X	--	--
Ordnance and accessories.	X	--	X
Engines and turbines.	X	--	X
Farm and garden machinery.	X	--	--
Construction, mining, and material handling machinery.	X	--	--
Metalworking machinery.	X	--	--
Special industry machinery, except metalworking.	X	--	X
General industry machinery.	X	--	--
Office, computing, and accounting machines.	X	X	X
Refrigeration and service industry machinery.	X	--	--
Electric transmission and distribution equipment.	X	--	X
Electrical industrial apparatus.	X	--	X
Household appliances.	X	--	--
Electric lighting and wiring equipment.	X	--	--
Radio and TV receiving equipment.	X	--	X
Communication equipment.	X	X	X
Electronic components and accessories.	X	X	X
Miscellaneous electrical machinery.	X	--	X
Motor vehicles and equipment.	X	--	--
Aircraft and parts.	X	X	X
Guided missiles and space vehicles.	X	X	X
Engineering, laboratory, scientific, and research instruments.	X	--	X
Measuring and controlling instruments.	X	--	X
Optical instruments and lenses.	X	--	X
Surgical, medical, and dental instruments.	X	--	X
Photographic equipment and supplies.	X	--	X
Radio and TV broadcasting.	X	--	--
Communication services.	X	--	--
Electric services.	X	--	--
Combination electric, gas, and other utility services.	X	--	--
Wholesale trade, electrical goods.	X	--	--
Wholesale trade, machinery, equipment, and supplies.	X	--	--
Computer and data processing services.	X	--	X
Research and development laboratories.	X	--	X
Engineering, architectural, and surveying services.	X	--	--
Noncommercial educational, scientific and research organizations	X	--	--

Note. Table taken from Riche, Hecker, and Burgan, 1983 (p. 52).

[a] Groups defined by the Bureau of Labor Statistics (see page 2).

Table 2

Projected Employment Growth for Three Scenarios by Employment Group
1982-1995

	Projected 1995 Employment[a]						Employment Change 1982-95		
	Low Growth		Moderate Growth		High Growth		Low Growth	Moderate Growth	High Growth
Employment Group	N	%	N	%	N	%	%	%	%
All wage and salary workers	115,383		117,745		120,531		25.5	28.1	31.1
Group I	16,261	14.1	16,613	14.1	16,932	14.0	31.7	34.5	37.1
Group II	3,518	3.0	3,410	2.9	3,453	2.9	38.3	34.1	35.8
Group III	7,747	6.7	7,720	6.6	7,890	6.5	36.1	35.6	38.6

Note. Table taken from Riche, Hecker, and Burgan, 1983 (p. 53). The assumptions underlying each growth scenario are given in Appendix C.

[a]In thousands.

Table 13

Participation Rates of Full-Time Employees in Employee Benefit Programs, Medium and Large Firms
1982

Employee Benefit	Participation by Professional and Administrative Employees %
Paid	
Holidays	99
Vacations	100
Personal leave	32
Rest time	61
Sick leave	92
Accident and sickness insurance	30
Noncontributory	22
Long-term disability insurance	63
Noncontributory	47
Health insurance for employee	98
Noncontributory	68
Health insurance for dependents	96
Noncontributory	43
Life insurance	98
Noncontributory	81
Retirement pension	87
Noncontributory	80

Notes.

1. Data taken from U.S. Department of Labor (August 1983).

2. Participation is defined by a time off, coverage by an insurance or pension plan. If employees are required to pay part of the cost of a benefit, only those who elect the coverage are counted as participants. Retirees are excluded even if participating in a benefit program. Coverage under these benefit programs is provided at no cost to employees.

To present actual examples of benefit packages, samples are provided in Appendix D for a large aerospace firm, a medium-sized computer firm, and the federal civil service. The life insurance plans provided by the two private sector firms are more generous than the federal government's, and both firms pay the employees' basic insurance premiums. Purchasing more life insurance is easier in the large firm and the federal government. The employer's size appears related to the number and variety of benefit plans, especially health, that are available to the employee. The federal government, for example, offers (at partial cost) a choice of more than 129 health plans, whereas the medium-sized firm

The BLS annually surveys medium and large firms (with at least 100-250 employees, depending on the industry) to collect information on the number of workers covered by specific benefit plans. Table 13 and the following extract summarize the BLS findings (U.S. Department of Labor, August 1983).

> The great majority of full-time workers within the scope of the 1982 survey of employee benefits were provided with health and life insurance and private retirement pension plans as well as paid holidays and vacations (see Table 13). The employer generally paid the full cost of providing benefits. Provisions of many employee benefits differed markedly between white-collar and production workers.
>
> On the average, employees received 10 paid holidays each year. The number of days of paid vacation, increasing with years of service, averaged nearly 16 days after 10 years and 21 days after 20 years.
>
> Ninety-three percent of all employees had some protection against loss of income due to short-term disability--either sick leave or accident and sickness insurance, or both. Workers with 5 years service who were covered by sick leave plans could take, or average, from 5 to nearly 15 weeks off with full pay per year or per disability, depending on the type of plan. Most of the workers covered by accident and sickness insurance had a benefit based on earnings. Most employees also had some protection for extended income loss due to disability; 43 percent had long-term disability insurance, and 49 percent were covered under private pension plans that provided immediate disability retirement benefits.
>
> Virtually all of the participants in health insurance plans were covered for most categories of expenses related to hospital and medical care. Life insurance was provided for nearly all employees, most commonly for an amount equal to annual earnings.
>
> Eighty-four percent of the employees in the survey were covered by private retirement pension plans. Benefits were most frequently based on earnings during the last years of employment. Virtually all covered employees could retire early with a reduced pension, provided they fulfilled minimum age/service requirements.
>
> Funeral leave, military leave, and full or partial defrayment of educational expenses were available to at least three-fifths of the employees. Fewer than one-fifth of the employees were eligible for stock purchase plans, company automobiles for private use, nonproduction bonuses and noncash gifts. (pp. 2-4)

Table 11

High-Technology Employment Growth as a Percentage of Total Nonagricultural Employment Growth in Top 10 States 1975-82

Group I		Group II		Group III	
Total U.S.	21.0	Total U.S.	5.8	Total U.S.	11.3
South Dakota	49.1	Massachusetts	18.3	Massachusetts	30.0
New Hampshire	43.1	New Hampshire	15.8	Vermont	26.9
Vermont	38.7	Vermont	11.5	South Dakota	25.1
Massachusetts	35.2	Arizona	10.6	New Hampshire	25.0
Nebraska	33.1	Maine	10.1	Connecticut	21.4
Rhode Island	32.6	California	10.0	Idaho	19.9
Idaho	32.4	Oregon	10.0	Maryland	19.9
Montana	31.5	South Dakota	10.0	District of Columbia	19.8
Delaware	30.7	Washington	10.0		
Colorado	30.3	Rhode Island	9.1	Rhode Island	19.2
				Oregon	18.0

Note. Data taken from U.S. Department of Labor (Riche et al., 1983). Employment groups are defined on page 2.

Table 12

Average Monthly Salary Offers to Bachelor's Degree Graduates 1984

Occupation	Private Industry $	Federal Government $
Engineer	2186	1731
Life or physical scientist	1621	1386
Mathematician	1950	1380
Computer scientist	2011	1587

Note. Data taken from College Placement Council (1984).

Table 9

Percentage of Total High-Technology Employment in the Five States With the Most High-Technology Employment[a]

	1975 %	1977 %	1979 %	1982 %
Group I[b]	38.4	37.8	38.3	37.4
Group II	46.7	47.1	47.6	47.5
Group III	41.6	40.9	40.4	40.7

Note. Data taken from U.S. Department of Labor (Riche et al., 1983).

[a]See Table 8 for the top 5 states in each group.

[b]Employment groups defined on page 2.

Table 10

1982 Average High-Technology Employment as a Percent of Total Nonagricultural Employment in Top 10 States Under Three Definitions

Group I		Group II		Group III	
Total U.S.	13.4	Total U.S.	2.8	Total U.S.	6.2
Delaware	24.0	New Hampshire	7.2	Delaware	16.2
New Hampshire	21.0	Vermont	7.0	Connecticut	13.0
Michigan	20.4	Connecticut	6.9	New Hampshire	12.5
Connecticut	20.3	Arizona	6.8	Vermont	11.7
Vermont	18.9	California	6.2	Massachusetts	11.7
Indiana	17.6	Massachusetts	6.1	New Jersey	10.3
Massachusetts	17.2	Washington	5.7	California	9.5
Texas	17.0	Kansas	4.7	Arizona	9.0
New Jersey	16.9	Utah	4.2	Washington	8.2
Kansas	16.5	Colorado	3.9	Kansas	7.8
Ohio	16.5				

Note. Data are a 9-month average. Data taken from U.S. Department of Labor (Riche et al., 1983). Employment groups are defined on page 2.

Table 8

Average Employment in Three Groups of High-Technology Industries in 10 States With Highest Levels of High-Technology Employment
1982

Group I		Group II		Group III	
Total U.S.	13,038.3	Total U.S.	2,633.7	Total U.S.	5,943.4
Top 10 States	7,489.5	Top 10 States	1,737.4	Top 10 States	3,566.6
California	1,527.5	California	610.6	California	933.1
Texas	1,068.4	New York	205.3	New York	493.4
New York	924.0	Massachusetts	160.7	Texas	372.0
Ohio	683.0	Texas	157.6	New Jersey	316.8
Illinois	672.0	New Jersey	116.9	Massachusetts	305.5
Michigan	651.0	Florida	108.1	Pennsylvania	277.0
Pennsylvania	615.4	Connecticut	98.5	Illinois	261.5
New Jersey	521.7	Illinois	96.2	Ohio	247.8
Massachusetts	450.0	Pennsylvania	93.3	Connecticut	185.8
Florida	376.5	Washington	90.2	Florida	173.7

Note. Because fourth quarter 1982 data were not available when this table was compiled, a 9-month average was used. Data are in thousands of jobs. Data taken from U.S. Department of Labor (Riche et al., 1983). Employment groups are defined on page 2.

The Los Angeles area, with a large aerospace industry, shows the highest level of high-technology employment by a large margin over San Jose, California. However, the

San Jose area, which contains "Silicon Valley," has the highest proportion of high-technology jobs in California: Regardless of the definition, one quarter to more than one third of this area's jobs are in high-technology industries.

Texas ranked second, third, and fourth in high-technology Groups I, II, and III respectively (see Table 8). Michigan has a high proportion in Group I, which includes auto manufacturing. Very few counties outside metropolitan areas have concentrations of high-technology jobs.

In 1982, while the share of the nation's high-technology employment in the 10 states with the most high-technology employment ranged from 57.4 to 66 percent among the three groups, these states had only 54.1 percent of the total nonfarm employment. As shown in Table 8, eight states--California, New York, Texas, Massachusetts, New Jersey, Florida, Illinois, and Pennsylvania--had substantial high-technology employment in all three employment groups. These states were also among the 10 with the most nonagricultural employment in 1982. However, the concentration of high-technology employment in the largest states does not appear to be increasing, regardless of the definition used. Table 9 shows the percentage of total high-technology employment in the top 5 states under each group for selected years.

Comparing a state's high-technology employment to its total nonagricultural employment produces a much different picture than looking at absolute levels. Smaller states appear near the top of the list (see Table 10). Massachusetts, despite its size, appears in the top 10 states for all three high-technology employment groups. The relative importance of high-technology among states, no matter how defined, shows that the New England states lead other regions in the proportion of such jobs. The area has a decaying industrial base and excellent educational institutions, like many high-technology areas.

High-technology industries generated only 4.7-15.3 percent of new U.S. jobs from 1972 to 1982, depending on the group. In narrowly defined Group II, nine states saw high-technology jobs account for 10 percent or more of the rise in their nonagricultural employment between 1975 and 1982 (see Table 11). Even when high technology is broadly defined as in Group I, it provides a relatively small proportion of total U.S. employment. Thus, for the foreseeable future, the bulk of employment expansion will take place in other industries.

Salaries and Benefits

The College Placement Council (CPC) regularly surveys placement officers at colleges and universities throughout the United States regarding job offers received by graduating students. Employers in industry and government, as well as nonprofit and educational organizations, cooperatively report starting salaries (but not fringe benefits) to the placement offices. Survey results are periodically published in the CPC Salary Survey.

The January 1984 CPC Salary Survey reports a 28 percent increase in the number of job offers over the previous year. Starting salaries, however, have not kept pace with this growth. Eight engineering disciplines reported starting salary increases of 1-4 percent. Petroleum engineers had the highest average monthly offer of $2502, followed by chemical engineers with $2215. Table 12 presents average monthly salary offers to bachelor's degree candidates in high-technology occupations.

Vetter (1982) concluded that, while the supply of scientists has caught up with demand in most fields except computer science, the picture for engineers is not so clear. It is not certain whether future supply will exceed demand, and if so, which fields will be affected.

Geographic Distribution

Nationwide, high-technology employment is not expected to take up the slack in job generation caused by the long-term decline in heavy durable goods industries, including those earlier defined as high-technology (see Employment Projections in High-Technology Industries). However, it will provide a significant proportion of new jobs in certain states and areas (see Figure 3). Local success stories include Northern California's Silicon Valley and the Route 128 area in Massachusetts and New Hampshire. Regardless of the definition used, most high-technology employment appears to be located in the largest metropolitan areas: The five largest metropolitan areas in each state accounted for between 72.7 and 93.2 percent of the high-technology jobs, depending on the state and definition used. Nonagricultural employment in these areas ranged from 63.7 to 74.2 percent of all employment in each state (Riche et al., 1983).

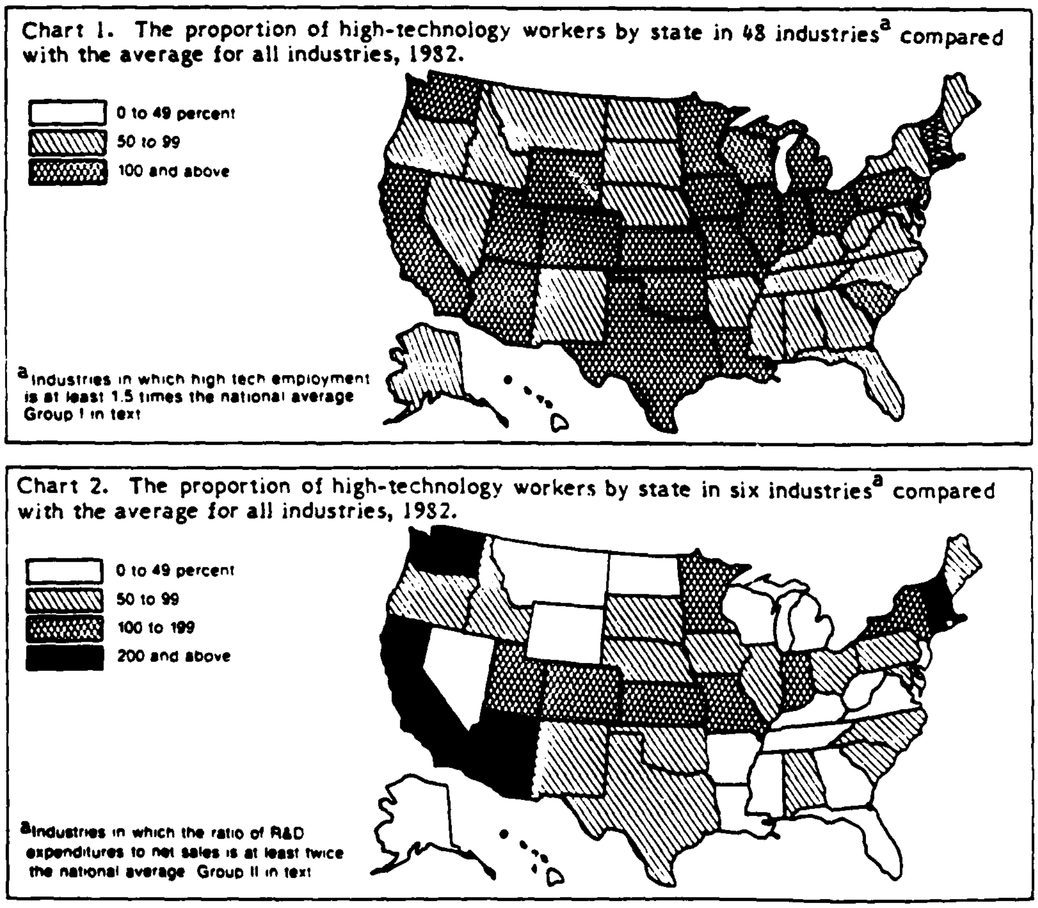


Figure 3. Geographic concentrations of high-technology workers.
Source: Riche, Hecker, and Burgan, 1983, p. 55.

In comparison to a study of employment demand in a particular industry, personnel demand for a special activity--magnetic fusion energy (Finn, Hansen, & Harr, 1981)--was examined by Oak Ridge Associated Universities. Actual 1981 employment and projections for 1990-2000 in this ambitious effort are presented in Table 7. Advanced research in fields such as magnetic fusion should increase the demand for scientists and engineers at the MS and PhD levels.

Table 7

Projected Employment in Magnetic Fusion Energy Occupations Funded by the Department of Energy 1981-2000

	Full-Time Person-Years					
	1981		1990		2000	
Occupation	BS/MS	PhD	BS/MS	PhD	BS/MS	PhD
Engineers						
Civil	43	1	23	25	18	8
Electrical/electronic	373	54	502	108	447	133
Industrial	18	6	29	14	29	11
Nuclear	55	53	103	155	115	160
Mechanical[a]	401	45	720	182	734	142
Engineering physics	19	14	49	50	64	100
Material science[b]	30	57	50	177	48	145
Other	32	19	22	39	12	12
Subtotal	971	249	1498	750	1467	711
Physicists						
Plasma	50	479	43	645	24	533
Solid state	0	30	0	51	0	61
Automic and molecular	0	27	0	30	0	0
Other	7	13	5	6	3	0
Chemists	19	12	15	34	13	22
Mathematicians	15	12	25	30	22	18
Computer scientists	74	12	136	27	154	19
Other, unspecified	29	0	33	0	31	8
Other professionals	116	5	203	14	131	8
Total	1281	839	1958	1587	1845	1380

Note. Data from Oak Ridge Associated Universities (Finn, Hansen, & Harr, 1981).

[a]Includes engineering mechanics.

[b]Includes metallurgy, material science, and ceramics.

Table 6

Projected Growth as a Percentage of 1980 Employment
1981-1985

Technical Professional Category	Employment Growth %
Electronic, electrical engineers	78
Mechanical engineers	70
Manufacturing and industrial engineers	81
Electronic engineer technologists	113
Computer software engineers	110
Analysts, programmers	130
Other computer professionals	129
Other technical professionals	38
Total: All technical professionals	76

Note. Data taken from American Electronics Association (Carey, 1981).

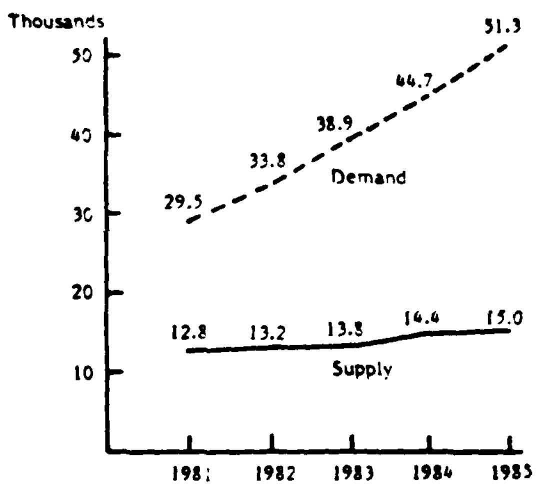


Figure 2. Comparison of projected supply and demand of electrical and computer engineers in U.S. electronics industries. Source: American Electronics Association (Carey, 1981).

Table 5

Comparisons of Projected Job Openings With Projected Degrees in Science and Engineering 1978-1990

	Job Openings (In Thousands) Scenarios				Graduates (In Thousands) Level	
	Baseline Assumptions	Accelerated Defense Spending	Synthetic Fuels Program	Balanced Federal Budget	Bachelor's Degrees	Master's Degrees
Engineers						
Aeronautical	24	35	24	24	28	NA
Chemical	22	22	22	21	92	NA
Civil	95	95	95	94	134	NA
Electrical	121	128	121	120	172	NA
Industrial	94	98	94	93	48	NA
Mechanical	89	95	89	89	171	NA
Petroleum	11	11	11	11	14	NA
Other	75	77	75	75	142	NA
Total	528	561	534[a]	525	928[b]	196
Life and physical scientists						
Agricultural	16	16	16	16	193	34
Biological	38	38	38	37	637	78
Chemical	63	64	64	63	178	26
Geological	22	22	23	22	67	18
Physics and astronomy	11	11	11	11	45	19
Other	7	7	7	7	15	7
Total	157	159	157	156	1,135	182
Mathematical sciences						
Mathematicians	3	3	3	3	102	27
Statisticians	19	19	19	19	3	5
Total	22	22	22	22	105	32
Computer professionals						
Programmers	300	302	300	299	NA	NA
Systems analysts	221	223	221	221	NA	NA
Other	28	29	28	28	NA	NA
Total	549	553	550	547	110	47
Total all fields	1,256	1,295	1,262	1,249	2,278	456

Note. Estimates of openings do not include academic employment. Data may not sum to totals because of rounding. Data taken from the National Science Foundation and the U.S. Department of Education (1980).

[a] Includes 4,000 engineers who are not distributed by field.

[b] Includes 128,000 engineering technology degrees not distributed by field.

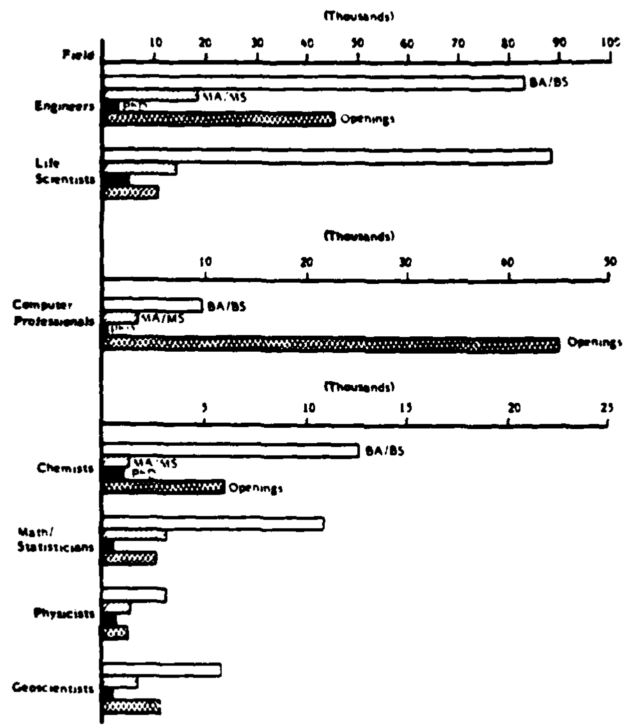


Figure 1. Projections of openings and degrees--annual averages, 1978-1990. (Vetter, 1982, p.4)

A study by the National Science Foundation (NSF) (1980) in collaboration with the Department of Education compared the number of job openings in science and engineering with projected degree production under various scenarios for 1978-1990 (Table 5). As shown, the projections indicate no shortage of graduates at the baccalaureate level except in industrial engineering. In some fields (e.g., biological scientists and mathematicians), the supply of bachelor's degree recipients exceeds expected openings under each scenario. This apparent surplus may disappear as some graduates pursue graduate study or gain employment in other fields. The NSF report does not match new computer science degrees with corresponding job openings because graduates comprise only a small fraction of new computer professionals. Master's degree projection are not available for the engineering fields.

A 1981 survey of 1265 electronic firms conducted by the American Electronics Association (Carey, 1981) revealed current and projected shortages of electrical and electronic engineers and computer scientists from 1981 through 1985. Of 21 technical professional occupations in the electronics and computer industries, computer specialists again show phenomenal growth--an average of over 120 percent in a span of 5 years (see Table 6). As noted previously, this trend is expected to hold up throughout the 1980s. Figure 2 compares projected supply and demand for electrical engineers in the period 1981-85.

Table 4

Employment Projections by Occupation and Economic Sector
1982-1995

Occupation by Sector	Employment Change: Low Growth %	Employment Change: Moderate Growth %	Employment Change: High Growth %
Engineers			
Total	48	49	52
Private industry	54	55	58
Federal government	35	22	30
Life and physical scientists			
Total	27	26	29
Private industry	30	33	34
Federal government	31	18	27
Mathematical specialists			
Total	31	29	32
Private industry	34	35	37
Federal government	28	16	24
Computer specialists			
Total	79	81	84
Private industry	84	87	90
Federal government	41	28	36

Note. Table taken from BLS data provided by Dr. Aline Quester of the Center for Naval Analyses, Alexandria, VA.

employees who retire, die, or simply leave the labor force (U.S. Department of Labor, September 1980). Nevertheless, graduates in some fields of study are expected to balance the number of openings. Figure 1 compares average annual numbers of graduates to job openings with respect to each degree level. In some jobs, such as engineers, chemists, geologists, and geophysicists, total openings are sufficient to absorb a large portion of the graduates at all levels, assuming that some graduates will opt for graduate school or pursue a profession in an alternate field. Computer professionals have by far the widest range of opportunities. Openings for life scientists and mathematicians should be able to absorb the PhDs and most MAs. Graduates in other fields, even advanced degree holders, will have limited opportunities.

Table 3

Projected Civilian Employment in Occupations with 25,000 Workers or More

	Employment in Thousands						
		Projected 1995			Employment Change: 1982-1995		
Occupation	Actual 1982	Low Growth N	Moderate Growth N	High Growth N	Low Growth %	Moderate Growth %	High Growth %
Engineers	1204	1787	1788	1831	48	49	52
Aero-astronautic	44	65	62	62	49	41	42
Chemical	56	79	80	82	41	43	47
Civil	155	226	228	236	45	47	52
Electrical	320	531	528	540	66	65	69
Industrial	160	226	227	232	41	42	45
Mechanical	209	314	318	327	50	52	56
Petroleum	26	31	32	30	19	22	16
Others	234	315	313	322	35	34	38
Life and physical scientists	271	343	342	348	27	26	29
Biologists	52	71	70	73	38	36	41
Chemists	89	107	108	111	21	22	25
Geologists	49	60	60	59	24	24	21
Others	81	105	104	105	30	28	30
Mathematical/statistical specialists	48	63	62	63	31	29	32
Computer specialists	521	935	943	960	79	81	84
Programmers	266	465	471	480	75	77	80
Systems analysts	254	469	471	480	85	85	89
Total	2044	3128	3125	3202	53	53	57

Note. Table taken from Silvestri, Lukasiewicz, and Einstein, 1983. The assumptions underlying each growth scenario are presented in Appendix C.

alternative for Groups II and III shows higher 1995 employment than the moderate alternative because these two groups have large proportions of workers employed in three industries related to defense: communication equipment, aircraft and parts, and guided missiles and space vehicles. Higher defense spending was assumed in the low-growth alternative.

BLS projects that 1.5-1.6 million high-technology jobs will be created between 1982 and 1995. Growth in Group I will account for about 16 percent of all new jobs, Group II, about 3 percent, and Group III, about 8 percent. High-technology jobs are relatively few in number but are projected to grow 45.3-49.3 percent, much faster than the 23-28 percent increase projected for all wage and salary workers (Riche et al, 1983).

Employment Projections in High-Technology Occupations

As high-technology industries continue their rapid growth, employment in this sector is expected to grow faster than the economy as a whole. The occupations that will experience the largest growth rates are scientists, engineers, technicians, and computer specialists. As shown in Table 3, from 1982 to 1995 the average projected employment change for these four occupations, assuming moderate economic growth, is 44 percent. The average for all occupations is 25 percent, including all professional and technical workers. Among high-technology occupations, computer specialists will experience the highest growth (81%), followed by the engineering community (49%). Employment trends for the civilian occupations shown in Table 3 were assumed to follow straight-line projections through 1995. The seemingly inconsistent growth patterns (from low to high) for some occupations (e.g., aero-astronautic engineers) are explained by the assumption of higher government spending for the low growth scenario, particularly in defense-related industries. This does not account for political changes that might affect the defense budget in the out years.

Table 4 presents the projected change in employment for each high-technology occupation classified according to private or public sector. Computer specialists and engineers in the private sector should experience the highest growth rates. In a span of only 13 years, 1982-1995, openings for computer specialists would nearly double. In contrast, government openings for these occupations are expected to grow less as a result of low overall federal employment growth.

Supply and Demand Imbalances

In the period 1969-1978, BLS found that 46 percent of college graduates found jobs in professional and technical occupations. With 29 percent entering managerial and marketing jobs, about one fourth took jobs not traditionally sought or filled by college graduates (Vetter, 1982). In the 1980s, Vetter projected that college enrollments in the 1980s would remain approximately level despite the decline of the 18-21-year-old population, partly because of the growth in the number of older students. Job market conditions in the 1980s are expected to be similar to those in the previous decade, as total entrants continue to exceed job openings traditionally sought by new graduates. As a result, about one graduate in four will again have to enter an alternate occupation or face unemployment.

According to Vetter (1982), although 13.5 million college graduates will join the labor force between 1978 and 1990, only 10.2 million "traditional" jobs will be available to new graduates. About half of the openings will result from general economic growth and vacancies due to upgrade or promotion, and the other half will be replacements for

offers one. However, dental and vision care are available at no cost in the two private companies. Such care is available only at cost under certain health plans in the federal government.

The federal government and the medium-sized computer firm pay disability premiums in full and offer fairly comprehensive coverage. The large aerospace firm, on the other hand, is responsible for only a small portion of the disability premium, and on top of that, the coverage is less comprehensive.

Retirement plans also vary considerably among the three packages, making comparison difficult. Unlike the federal government's, the large aerospace firm's retirement plan does not cost the employee anything. Stock savings and stock purchasing options are further available, adding to the plan's attractiveness. In contrast, the medium-sized computer firm offers no retirement plan per se, but this omission results from the company's recent establishment and does not reflect industry-wide practice.

Finally, the private sector employees enjoy more holidays in a year than federal employees. Other vacation benefits have only minor dissimilarities, and as is regularly the case, vacation days accrue with length of service and at specified tenure points.

CONCLUSIONS

Rapid technological advancement in the last decade has resulted in the utilization of practically all available scientists and engineers. While the number of bachelor's degree graduates in engineering, mathematics, and physical sciences (EMP) has increased since the mid-1970s, job openings in high-technology industries have also grown. Whether based on growth trends in specific industries or in selected occupations, the demand for these highly trained workers is not expected to slacken. Based on long-term projections, the Navy should not experience shortages in the URL community. However, the retention of computer-trained officers may ultimately pose problems because the number of jobs for computer professionals exceeds the number of graduates by a wide margin.

Projections of future demand are generated on the basis of either past trends coupled with demographic data, or surveys of hiring plans of major employers. BLS uses economic trend models hedged by consideration of predicted federal R&D budgets, defense expenditures, and industrial expansion. Federal funding and appropriations are also major determinants and, hence, leading indicators of actual and future demand.

An alternative index of demand for scientists and engineers is the High Technology Recruitment Index maintained by the advertising firm of Deutsch, Shea, and Evans. The index gauges classified advertising for scientists and engineers in newspapers and technical journals. The monthly indices have remained high since 1978, in contrast to the low demand of the early to mid-1970s (Vetter, 1982).

Ongoing programs of the present administration to bolster national defense and revitalize industry may reinforce demand in most fields of engineering throughout the decade. While only about 8-10 percent of college students majored in EMP fields in the 1970s, the accelerated pace in high-technology research and application in the 1980s is bound to increase the demand for EMP graduates (National Science Foundation, 1983). Although the proportion of college-age population will decline in the 1980s, college enrollments are expected to stay approximately level as a larger proportion of high school graduates and older students attend college (Vetter, 1982). Since measures to raise (or

reduce) the supply of newly trained scientists and engineers in response to current and anticipated demand normally require a lead time of 4-8 years, a change in supply tends to lag behind a change in demand, resulting in seemingly chronic shortfalls in the supply of certain professional skills.

According to the College Placement Council (1984), the present economic recovery is expanding the job market for most college graduates. The number of job offers for engineers is up, and salaries in several high-technology occupations for bachelor's degree graduates have risen over the last 2 years. Due to the explosive growth of the computer industry, a shortage of computer specialists should persist for the time being. If current demand for technical personnel is sustained, the overall impact should favor future EMP graduates.

Some of the more significant developments in employee compensation have occurred in the private sector. For example, 98 percent of professional and administrative personnel now participate in some form of health and life insurance program. Of these, 68 percent subscribe to a health plan and 81 percent have life insurance. Moreover, 80 percent participate in a retirement pension plan (U.S. Department of Labor, August 1983). The life and retirement plans are typically paid in full by the medium and large employers. Additional benefits that these firms offer include stock saving or purchase plans, as well as disability and travel accident insurance.

RECOMMENDATIONS

1. In the next decade, the Navy should closely monitor the high-technology labor market and have in place the mechanisms needed to combat potential URL shortfalls, particularly for computer professionals.

2. If the present demand for technically trained graduates is sustained, the armed services should assess the benefits currently offered military officers. Either higher pay or an enhanced benefits package may have to be implemented if the military is to attract and retain officers in skill shortage categories.

REFERENCES

Andreassen, A. J., Saunders, N. C., & Su, B. W. (November 1983). Economic outlook for the 1990's: Three scenarios for economic growth. Monthly Labor Review, 106(11), 11-23.

Carey, M. L. (August 1981). Occupational employment growth through 1990. Monthly Labor Review, 101(8), 42-53.

College Placement Council. (January 1984). CPC salary survey (Formal Rep. No. 1). Bethlehem, PA: Author.

Engineering Manpower Commission. (April 1981). A pilot study of the demand for engineering, 1980 (Pub. No. 231-80). New York: Author.

Finn, M. G., Hansen, A. H., & Harr, P. A. (September 1981). Manpower requirements and supply for magnetic fusion energy, 1981-2000 (ORAU-184). Springfield, VA: U.S. Department of Commerce.

National Science Foundation and the Department of Education. (October 1980). Science and engineering education for the 1980s and beyond (NSF 80-78). Washington, DC: U.S. Government Printing Office.

National Science Foundation. (1983). Science indicators 1982 (NSB-83-1). Washington, DC: U.S. Government Printing Office.

National Science Foundation. (January 1984). Women and minorities in science and engineering. Washington, DC: U.S. Government Printing Office.

Naval Military Personnel Command. (September 1983). Annual report--Navy military personnel statistics (NAVPERS 15658(A)). Washington, DC: U.S. Government Printing Office.

Quester, A. (February 1984). (U.S. Department of Labor data) Unpublished computer printouts. Alexandria, VA: Center for Naval Analyses.

Riche, R. W., Hecker, D. E., & Burgan, J. U. (November 1983). High technology today and tomorrow: A small slice of the employment pie. Monthly Labor Review, 106(11), 50-58.

Silvestri, G. T., Lukasiewcz, J. M., & Einstein, M. E. (November 1983). Occupational employment projections through 1995. Monthly Labor Review, 106(11), 37-49.

U.S. Department of Labor. (September 1980). Occupational projections and training data (Bulletin 2052). Washington, DC: Bureau of Labor Statistics.

U.S. Department of Labor. (March 1982). Economic projections to 1990 (Bulletin 2121). Washington, DC: Bureau of Labor Statistics.

U.S. Department of Labor. (December 1982). Occupational projections and training data (Bulletin 2202). Washington, DC: Bureau of Labor Statistics.

U.S. Department of Labor. (August 1983). Employee benefits in medium and large firms (Bulletin 2176). Washington, DC: Bureau of Labor Statistics.

Vetter, B. H. (January 1982). Supply and demand for scientists and engineering (2nd ed.). Washington, DC: Scientific Manpower Commission.

APPENDIX A

EDUCATION LEVELS ATTAINED BY NAVY COMMISSIONED OFFICERS ON ACTIVE DUTY 1970-1983

Table A-1

Education Levels Attained by Navy Commissioned Officers on Active Duty
1970-1983

	High School or Less		Fewer Than 4 Years of College		Bachelor's Degree		Post-Graduate Education		Not Recorded	
Date	Total Officers	%	Total Officers	%	Total Officers	%	Total Officers	%	Total Officers	%
1970	6,789	8.4	10,728	13.1	46,433	57.2	16,352	20.1	881	1.1
1971	5,925	7.6	9,554	12.3	45,136	58.2	16,014	20.6	943	1.2
1972	5,180	7.0	8,338	11.1	43,117	57.6	16,302	21.8	1,860	2.5
1973	4,676	6.6	8,029	11.3	40,071	56.2	16,864	23.6	1,715	2.5
1974	4,246	6.2	7,153	10.5	39,070	57.2	16,448	24.1	1,272	1.9
1975	3,047	4.8	5,203	8.1	38,382	60.0	15,948	24.9	1,449	2.3
1976	2,986	4.7	5,016	7.9	37,907	59.6	16,417	25.8	1,304	2.0
1977	2,669	4.2	4,229	6.7	37,306	58.9	16,466	26.0	2,642	4.2
1978	2,534	4.0	3,874	6.2	36,835	58.8	16,159	25.8	3,237	5.2
1979	2,391	3.8	3,564	5.7	36,399	58.5	15,979	25.7	3,915	6.3
1980	2,077	3.3	3,239	5.1	36,971	58.4	15,038	23.8	5,932	9.6
1981	1,964	3.0	3,117	4.7	38,558	58.7	15,241	23.2	6,806	10.6
1982	1,797	2.7	2,919	4.3	40,209	59.6	16,163	24.0	6,385	9.5
1983	1,760	2.5	2,907	4.1	41,868	59.9	17,454	25.0	5,924	8.5

Note. Table data include TARS, warrant officers, women, and retired officers on active duty (Naval Military Personnel Command, 1983).

APPENDIX B

SCIENCE AND ENGINEERING BACHELOR'S DEGREE RECIPIENTS
1970-1980

Table B-1

Science and Engineering Bachelor's Degree Recipients
1970-1980

Year	Women	Men	Total
1970	25,698	121,863	147,561
1971	25,000	120,703	145,703
1972	26,127	121,497	147,624
1973	28,256	126,556	154,812
1974	31,797	127,816	159,613
1975	34,165	122,891	157,056
1976	37,049	122,674	159,723
1977	39,734	123,666	163,400
1978	42,548	125,101	167,649
1979	45,175	127,663	172,838
1980	47,508	129,696	177,204

Note. Degrees include engineering, as well as the physical, mathematical (statistical and computer), and life sciences. Data taken from National Science Foundation (1982).

APPENDIX C

LOW, MODERATE, AND HIGH GROWTH SCENARIOS FOR THE U.S. ECONOMY THROUGH 1995

LOW, MODERATE, AND HIGH GROWTH SCENARIOS FOR THE U.S. ECONOMY THROUGH 1995

Low, moderate, and high growth scenarios (see Table C-1) for the U.S. economy were taken from Andreassen, Saunders, and Su, 1983, pp. 11-23.

Alternatives to Moderate Growth

The high-growth and low-growth versions of the projections vary the assumptions regarding fiscal and monetary policy. By 1995, real gross national product ranges between a low of $2,127 billion and a high of $2,265 billion, accompanied by unemployment rates of 6.8 percent and 5.2 percent for the low and high respectively.

High Growth

The major assumption in the high scenario is that the Federal Reserve Board pursues a less restrictive monetary policy than in the moderate growth projections. The assumption is that the Board of Governors allows more rapid monetary growth in order to bolster recovery from the 1981-82 recession and to sustain a higher trend growth over the long run.

No real differences were assumed for fiscal policy in the high-growth projection. The higher inflation rates do, however, result in government expenditures growing more rapidly throughout the period. Federal expenditures rise at a rate of 7.8 percent each year between 1982 and 1995, as compared to the moderate-growth expenditures increase of 6.7 percent. Finally, higher rates of income growth mean greater government revenues, which lead to a balanced federal budget in 1990.

Low Growth

This alternative simulation assumes higher levels of government spending, especially in defense, but also in transfers and grants. Federal expenditures grow at a rate of 9.4 percent each year between 1982 and 1990 and at 7 percent during the 1990-95 period. This growth compares to 7.5 percent and 6.1 percent growth over the same periods in the moderate-growth scenario. Defense growth is about 1.5 percent higher each year between 1982 and 1988, reflecting somewhat higher staff levels and greater expenditures on goods. Transfer payments are higher in every category, with the major increase in social security and medicare. As a result of the more aggressive (or less controlled) fiscal policy, the federal government runs deficits of about $200 billion for the remainder of the decade, with only modest tapering after 1990 to about $160 billion by 1995.

In addition, the monetary authorities are assumed to be generally more restrictive in order to hold down inflation. Both M1 and M2 grow at about 0.6 percent lower rates than in the moderate-growth projections. As a result, both short- and long-term interest rates are pushed higher, remaining in the double-digit range over the entire forecast period.

Table C-1

Past and Projected Growth Rates Under Three Growth Scenarios for the U.S. Economy

	Real GNP (%)	Disposable Income (%)	Employment (%)
Past growth			
1955-68	3.7	3.9	1.5
1968-73	3.5	4.3	1.7
1973-77	2.2	2.2	1.6
1977-82	1.6	2.4	1.6
Low growth			
1982-90	2.8	2.4	1.4
1990-95	2.7	2.7	1.6
Moderate growth			
1982-90	3.2	2.8	1.8
1990-95	2.5	2.6	1.5
High growth			
1982-90	3.8	3.2	2.3
1990-95	2.5	2.7	1.7

APPENDIX D

EMPLOYEE BENEFIT SUMMARIES

Table D-1

Employee Benefits in a Large Aerospace Firm

Eligibility	Summary	Paid By
	Health Plans	
Enrolled in the basic health and dental plans on the first day of employment with life insurance benefits equal to 1-1/4 times salary. Full flexible benefits options will be made available after your 1st month of employment.	The basic health insurance plan provides up to 120 days of hospital care including surgical procedures with no deductible. Other medical charges are paid at 80 percent after a $75 deductible per family member. Plans with either improved benefits or lesser benefits are also available, as is coverage through Kaiser and several health maintenance organizations. Employees have life insurance equal to 1-1/4 times their salary with the option to buy more insurance for themselves and their dependents. The basic dental plan provides 80 percent of the cost of dental services after $25 annual deductible per family member. Two teeth cleanings a year are covered at the 80 percent rate with no deductible. Orthodontia is covered at 50 percent for dependent children with a lifetime maximum of $500 per child. An alternative plan is available through *Safeguard Dental Plan*. (California employees only.)	Basic health, dental and life insurance is fully company paid. A charge will be made for selection of improved coverage or a cash credit allowed for selection of reduced coverage.
	Vision Care	
1st day of work.	You and your eligible dependents are covered for vision examinations every 12 months, lenses every 12 months if needed, and frames, every 24 months if needed. When you select a doctor from the Plan you pay only a deductible of $10 for each covered person. If you choose a doctor who is not a Panel member, you will be reimbursed according to a schedule. The Plan also covers $75 of charges for contact lenses, or more if medically necessary. (Contacts are in lieu of other services.)	The firm.
	Short-Term Disability	
1st day at work (employees have opportunity to remain in State Plan or participate in Voluntary Plan).	Dependent on pay, provides up to $175 weekly for up to 39 weeks. Begins 8th consecutive day of disability or first day of hospitalization. (Applicable to California personnel only.)	Employee (mandatory deduction in California).

PREVIOUS PAGE IS BLANK

Table D-1 (Continued)

Eligibility	Summary	Paid By
	Temporary Disability Insurance	
Voluntary at 1st day of work. (Non-California employees only.)	Provides a maximum weekly benefit of $105 for up to 26 weeks. Begins the 8th day of illness/hospitalization or 1st day of an accident.	Employee.
	Long-Term Disability	
1st day of work.	Income protection equal to 60 percent of salary payable until recovery or age 70. Benefits are payable for a 5-year period or to age 70, whichever comes first, if the disability commences at age 60 or after. Benefits payable after 6 months of total disability.	Shared by employee and the firm (voluntary plan.)
	Sick Pay	
1st day of work.	A unique concept that allows employees to draw from a "pool" dependent *on need*. The actual amount of days available to an employee is determined by length of service, previous use of the "pool," and the nature of the illness.	The firm.
	Travel Accident	
1st day of work.	Provides $50,000 insurance for accidental death during personal travel, and 5-1/2 times salary up to $100,000 for death while traveling on company business.	The firm.
	Retirement Plan	
1st day of work (if under 60 years of age).	Provides benefits based on 40 percent of the highest 5 years of consecutive earnings at the company and on social security benefits. Benefits reduced proportionately for less than 30 years of service. Full vesting occurs after 10 years, partial vesting after 5 years of employment.	The firm.

Table D-1 (Continued)

Eligibility	Summary	Paid By
	Stock Savings Plan	
After 6 months of employment.	Savings may be invested in (1) the Firm Stock Fund, (2) Diversified Equity Fund, (3) Fixed Income Fund, (4) Insured Return Fund, (5) A combination of the above. Vesting in the company poartion occurs 24 months after the end of the calendar year in which the employee makes contributions. Distribution is available at that time, or payment of account may be deferred.	Company matches $1 for every $2 of employees first 6 percent of contributions. Employee may contribute up to 12 percent (voluntary program).
	Holidays	
3 months of service required before taking first personal holiday, 6 months for the second.	Provides 14 holidays a year, two of which are personal holidays.	The firm.
	Vacation	
1st day of work.	Provides 5 days after the first 6 months, 10 days after year of employment. Thereafter earn 1/2 day extra for every year of service with a maximum of 25 days per year.	The firm.
	Education	
1st day of work.	Variety of programs including tuition reimbursement, colloquium and invited lecture series, graduate fellowship programs, and on-premises after-hours programs.	Depends on activity.
	Services	
1st day of work.	Variety available including credit union, employee services, blood bank, technical library, health units, and systems employee association.	NA

Table D-2

Employee Benefits in a Medium-sized Computer Firm

Eligibility	Summary	Paid By
	Health Plan	
1st day of employment.	Major medical plan that pays 80 percent of medical expenses up to $2,500 per year, and 100 percent thereafter. The firm will pay the difference between eligible expenses and the amount reimbursed by the insurance carrier. Maximum yearly reimbursement is $2,000 and can be divided between medical, eye care, and dental care. The firm will pay up to $200 per year toward the cost of an employee's annual physical exam.	The firm.
	Dental Plan	
Employee and dependents are eligible after 3 months.	50 percent of total dental expenses are covered and the reimbursement programs pay excess up to the designated $2,000 limit.	The firm.
	Life Insurance	
1st day of employment.	The amount of insurance equals twice the imployee's annual pay rounded to the next thousand.	The firm.
	Vision Care	
After 3 months.	The firm will pay a single eye care charge per person, of up to $250 per year, calculated from the date of the last charge.	The firm.
	Disability	
	If disabled longer than 3 months, you will be paid up to 2/3 of regular monthly salary, to a maximum of $4,500 per month.	The firm.
	Sick Pay	
All employees covered from the 1st day.	Sick days accrue at the rate of 1 day per month. After 90 days, one is eligible to use sick leave.	The firm.

Table D-2 (Continued)

Eligibility	Summary	Paid By
	Travel Accident Insurance	
From 1st day of employment.	Employee is covered by $75,000 travel insurance. Additional travel insurance can be purchased through the firm.	The firm; additional travel insurance paid by employee.
	Retirement	
After 6 months.	Current retirement plans include (1) profit sharing, which the employee is eligible to participate in after 6 months of employment, and (2) the stock purchase plan discussed next.	Employee.
	Stock Savings Plan	
Eligible after 6 months.	Employees are eligible to purchase company stock below market rates and without paying a broker's fee. In addition, employees are eligible to participate in the firm's profit sharing program.	Employee.
	Holidays	
All employees eligible from the 1st day.	The firm has a holiday policy which includes at least 12 holidays per year, including the week between Christmas and New Years.	The firm.
	Vacation	
Employees eligible after 6 months.	Employees are eligible for 1 week of paid vacation after 6 months of employment, and an additional week after 12 months. After completion of 2 years of service, 2 weeks of vacation is earned. After completion of 4 years, 3 weeks of paid vacation, and after 10 complete years of service, 4 weeks.	The firm.
	Education	
Eligible after 3 months of employment.	Costs of books and tuition will be paid by the firm if managerial approval is obtained prior to taking the course and one receives an acceptable course grade. Courses then should be of mutual benefit to the company and employee.	The firm.

Table D-3

Federal Employee Benefits

Eligibility	Summary	Paid By
	Health Plans	
Enrollment in the government-wide service benefit or indemnity plan is open to any employee eligible to participate. There are 129 other health benefit plans where eligibility for enrollment varies. Coverage through Kaiser and several health maintenance organizations is also available.	One of the government-wide plans, Blue Cross/Blue Shield provides up to 180 days of hospital care at 100 percent and at 75 percent thereafter. This plan also pays 75 percent of customary and reasonable inpatient services for surgery and doctor visits. In addition, 75 percent of all outpatient services are covered.	The government pays 60 percent of the average high option premium of six large and representative plans. However, the government's contribution may not exceed 75 percent of the total premium.
	Dental Plans	
Dental plans are provided through some of the health plans where eligibility for enrollment varies.	Services vary from plan to plan.	Same as health plans.
	Life Insurance	
All federal civilian employees are eligible for basic life insurance unless they waive the insurance in writing.	Two kinds of insurance: (1) life insurance, and (2) accidental death and dismemberment insurance. The amount of each kind of insurance equals an employee's annual pay rounded to the next higher thousand plus $2,000, with a minimum of $10,000 insurance for all those earing $8,000 or less, at all times during active employment. Maximum amount of basic insurance for any employee is $75,000. Standard optional life insurance of an additional $10,000 is available to those under basic insurance. Or, additional optional insurance for those under basic equal to one, two, three, four, or five times actual rate of annual basic pay after first rounding to the next $1,000. Maximum amount of basic pay is $73,000.	Employee pays 2/3 and the government the remainder for basic coverage. Additional coverage is paid by the employee.
	Vision Care	
Provided through some of the health plans where eligibility for enrollment varies.	Services vary from plan to plan.	Same as health plans.

Table D-3 (Continued)

Eligibility	Summary	Paid By
	Disability	
From 1st day.	Basic compensation for total disability is 2/3 of monthly pay. This is increased to 3/4 of monthly pay if the injured employee has a spouse, minor child, or wholly dependent parent. No compensation is payable for the first 3 days of wage loss unless the disabiality exceeds 14 days or injury results in permanent disability. Maximum monthly compensation cannot exceed 3/4 of the highest monthly pay level for GS-15. Minimum monthly compensation for total disability cannot be less than 3/4 of the lowest monthly pay level for GS-2, but the minimum may not exceed the employee's monthly pay, except for increases from cost-of-living adjustments. Compensation for partial disability is based on loss of wage earning capacity.	Government.
	Sick Pay	
From the 1st day.	Full-time employees earn 13 days of sick leave a year. There is no limit to the amount of sick leave that can be accumulated.	Government.
	Travel Accident Insurance	
N/A	N/A	N/A
	Retirement Plan	
From the 1st day.	Provides benefits based on the highest average pay produced by the employee's basic pay rates during any 3 consecutive years of service. The basic annuity formula is: (1) for employees with more than 10 years of service: (1-1/2% of the "high 3" average pay x 5) + (1-3/4% of the "high 3" average pay x 5) + (2% of the "high 3" average pay x years of service--10), (2) for employees with less than 10 years of service: (1-1/2% of the "high 3" average pay x service years up to 5) + (1-3/4% of the "high 3" average pay x service years over 5, but less than 10). The basic annuity for an employee who retires before age 55 is reduced by 2 percent for each year under 55. Service includes military service.	Employee.

Table D-3 (Continued)

Eligibility	Summary	Paid By
	Stock Savings Plan	
N/A	N/A	N/A
	Holidays	
From 1st day.	Provides 9 holidays per year.	Government.
	Vacation	
Most employees eligible.	Annual leave is earned on the basis of years of federal service, including creditable military service. Full-time employees with 15 years or more of service earn 26 days of annual leave a year; those with 3 but less than 15 years earn 20 days; and those with less than 3 years earn 13 days.	Government.
	Education	
Most employees eligible with more than 1 year of service. For those with less than 1 year, only in the public interest can training be undertaken.	Employees sponsored for nongovernment programs of larger than 80 class hours must agree to remain with the agency for a minimum of one to three times the length of the training period depending on the salary status during the training period or repay the training cost.	Government.
	Moving Expenses	
All employees.	Travel, transportation, and other allowances are authorized by federal agencies for employees who are transferred from one official station to another for permanent duty provided that the transfer is in the interest of the government and that employees agree in writing to remain in the service of the government for 12 months.	Government.
	Services	
All employees.	Credit union, employee services, technical library.	N/A

DISTRIBUTION LIST

Chief of Naval Operations (OP-01B4), (OP-01B6), (OP-01B7) (2), (OP-130D), (OP-132E), (OP-135C4), (OP-136)
Commander, Naval Military Personnel Command (NMPC-013C)
Commander, Navy Recruiting Command (Code 20)
Chief of Naval Research (Code 270), (Code 440), (Code 442), (Code 442PT)
Commanding Officer, Office of Naval Research Branch, Chicago (Coordinator for Psychological Sciences)
Chief of Naval Education and Training (Code 00A), (Code N-21)
Chief of Naval Technical Training (Code N-6)
Commanding Officer, Naval Technical Training Center, Corry Station (Code 101B)
Commanding Officer, Naval Training Equipment Center (Technical Library) (5), (Code 1)
Commandant of the Marine Corps (MPI-20)
Commander, Army Research Institute for the Behavioral and Social Sciences, Alexandria (PERI-ASL), (PERI-ZT), (PERI-SZ)
Commander, Air Force Human Resources Laboratory, Brooks Air Force Base (Manpower and Personnel Division) (2), (Scientific and Technical Information Office), (TSRL/Technical Library
Commander, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base (AFHRL/LR-TDC)
Commanding Officer, U.S. Coast Guard Research and Development Center, Avery Point
Director of Research, U.S. Naval Academy
Institute for Defense Analyses, Science and Technology Division
Defense Technical Information Center (DDA) (12)

END

FILMED

10-85

DTIC